

PROCEEDINGS
OF THE
CALIFORNIA ACADEMY OF SCIENCES
FOURTH SERIES

VOL. X, No. 1, pp. 1-27, pls. 1-2

AUGUST 6, 1920

I

A FURTHER STUDY OF VARIATION IN THE
GOPHER-SNAKES OF WESTERN NORTH
AMERICA

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In August of last year the writer and Joseph R. Slevin published the results of a study of some three hundred specimens of *Pituophis* from western North America¹. Probably no one who has not undertaken such a study can realize the amount of time and effort necessary for gathering, analyzing, digesting, and formulating the data derived from such a mass of material as was involved in our earlier study of the garter-snakes of the genus *Thamnophis*. The time and effort expended were so great that in the subsequent study of *Pituophis* the attempt was made to reach conclusions without so much attention to detail. The result was that, while the conclusions reached were valuable and probably correct, as far as they went, they never have been satisfactory as a solution of the problems in variation and distribution offered by this genus. Further study of the data published in that paper indicated the probability that the snakes

¹ The Gopher-Snakes of Western North America. <Proc. Cal. Acad. Sci., 4th Ser., vol. 9, no. 6, pp. 197-220, pls. 11-13, August 21, 1919.

we had regarded as one subspecies, and called *Pituophis catenifer annectens*, were not all alike, but represented several centers of geographic variation. It has seemed important to determine whether this actually is so, and whether conclusions more satisfactory than those published could be attained by further study of the group.

Such study required additional data. The color patterns of these snakes had not been considered in our former investigation for the reason that published records seemed to show so much variation as to render them valueless as a means of classification. Investigation of them now, however, shows that they do afford valuable data. Individual variation is great, but so are the average differences found in several geographic areas. The whole subject has been reopened, and the results of additional study are given in the present paper.

Reverting to the former paper, it may be recalled that it was there shown that the gopher-snakes of western North America may be divided into two groups by the number of their gastrostege. This is indicated in the following diagram, figure 1, in which the upper curve represents the gastrostege counts in the snakes we called *Pituophis catenifer catenifer*, while the lower curve shows the same data concerning those regarded as *Pituophis catenifer annectens*:



Fig. 1

As one proceeds south and east from the cool north coast regions toward the warm south coast and interior desert regions, the average counts gradually increase. Although the transition is gradual, these gastrostege counts are of great use in the separation of these snakes into the two groups which we then regarded as two subspecies.

This same difference and relationship are shown when the combined gastrostege and urostege counts are charted for the two groups, as has been done in figure 2. In this chart the

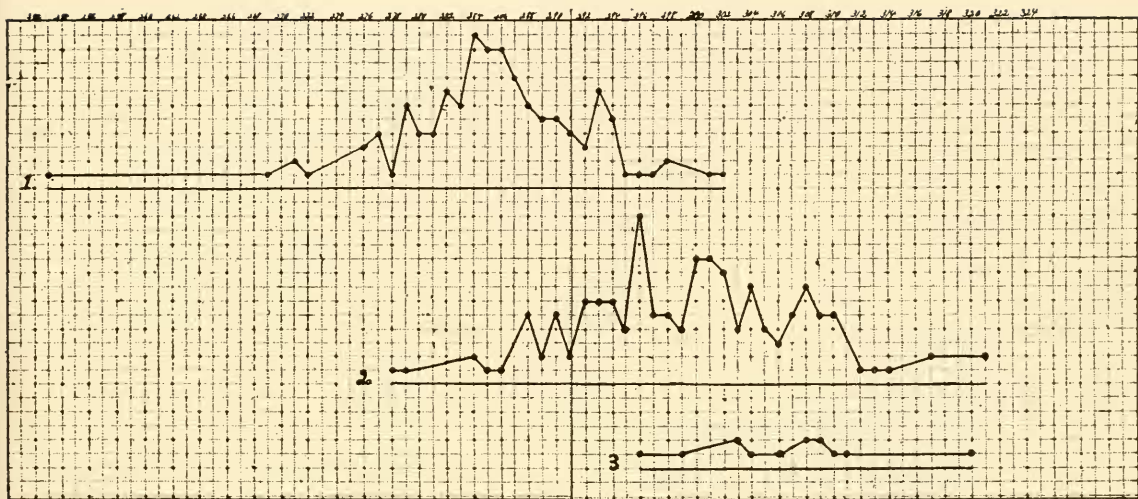


Fig. 2

upper curve (1) represents the counts in the snakes we called *P. catenifer catenifer*, the middle curve (2) those for *P. catenifer annectens*, and the lower curve (3) the same counts for *P. vertebralis*. That there is a very real difference between the first group and the others is evident.

Turning now to a consideration of the number of dorsal blotches between the head and tail (at a point over the anus), we find that the snakes which have fewer gaurosteges are not all alike. Those from near the coast have more blotches than those from the interior. The same is true of the snakes with more numerous gaurosteges. The coast snakes have more numerous blotches than those from the interior. Figure 3 shows the number of blotches on the body in gopher-snakes from several geographical areas. The upper two curves (1 and 2) represent the snakes with fewer gaurosteges, which we called *Pituophis catenifer catenifer*. It will be seen that there is a marked difference between these two curves. The upper curve (1) represents the snakes from the coast valleys and ranges from Oregon to Santa Barbara County, California. The second curve (2) shows the number of blotches in the snakes of this group from the Klamath-Modoc region, the Sacramento Valley, the western slope of the Sierra Nevada,

and the northern portions of the San Joaquin. The difference between these two curves points to the necessity of recognizing two subspecies here, a coast race, *P. catenifer catenifer*, and an interior race, *P. catenifer heermanni*.

The third, fourth, fifth, and sixth curves charted in this figure 3 represent respectively snakes (3) from the San Diegan Fauna, (4) from the desert regions of California, the southern San Joaquin Valley and Nevada, (5) from Utah, and (6)

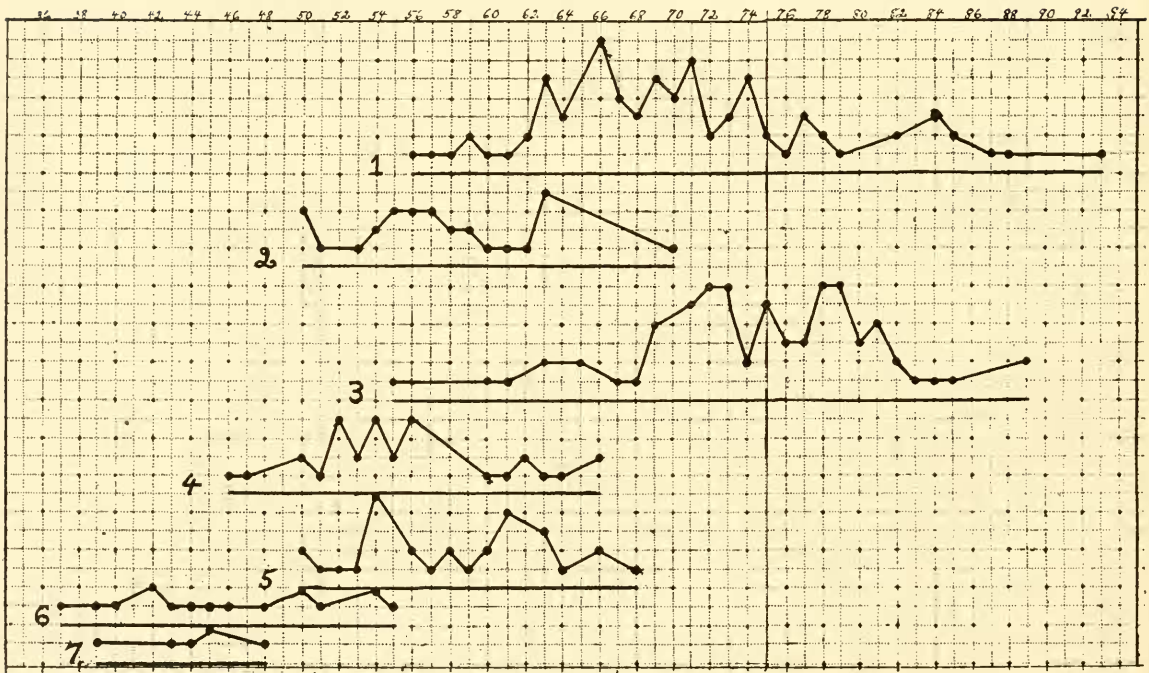


Fig. 3

from Arizona. Curve 3 shows that the snakes from the coast of southern California have more blotches than those of any of the other regions where the gastrosteges are numerous. In this respect these snakes are like those from the northern coast, *P. catenifer catenifer*, from which, however, they differ in other respects. The difference between these snakes and those represented by the other curves necessitates recognition as a distinct subspecies, *P. catenifer annectens*, using this name in a restricted sense.

The sixth curve, representing the snakes of Arizona, also shows marked difference from all of the others of this group. The number of blotches is much reduced and is similar to that found in *Pituophis vertebralis*, shown in the seventh curve. It would seem that the Arizona snakes also are entitled to sub-specific rank.

This leaves curves 4 and 5, which agree with each other and with curve 2. Bearing in mind the fact that the snakes of curve 2 (*P. c. heermanni*) belong to the group having fewer gastrosteges, it seems necessary to regard those represented by curves 4 and 5 as deserving separate standing.

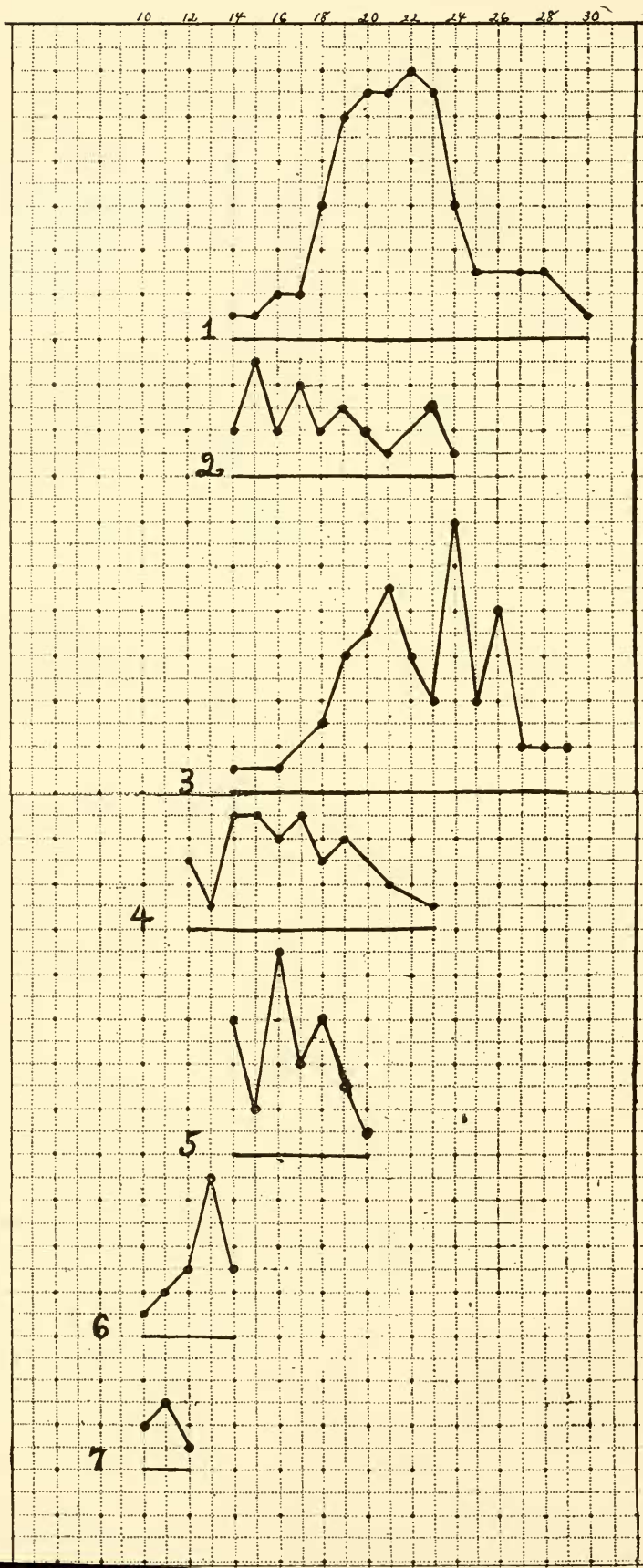
It will be shown later that the snakes of Utah (curve 5) differ from those represented by curve 4. For the latter, the name *P. catenifer deserticola* would seem to be available.

The number of blotches on the tail in these various races has been charted in figure 4. The same differences and relationships as are indicated by the blotches on the body are shown by these data.

Turning now to a consideration of the scale-rows we find that the greatest number present on the body, although subject to great individual variation, also shows geographic variation. This is brought out in figure 5. Curves 1 and 2, representing *P. c. catenifer* and *P. c. heermanni*, agree in showing 31 rows as the most frequent number. The Arizona specimens (curve 6) and those of *P. c. annectens* (3), and *P. c. deserticola* (4) agree, and show 33 as the most frequent number. *P. vertebralis* (curve 7) stands by itself in having 35 rows as the usual number. At the other extreme stand the Utah (curve 5) specimens, of which only 25 per cent have as many as 31 rows, while the majority have only 29. These Utah snakes are thus quite different from typical *P. c. deserticola*.

In figure 6 are charted the number of urosteges in specimens of these several races. Curves 1 and 3 are of interest as showing that *P. c. annectens* (3) usually has more urosteges than *P. c. catenifer* or any of the other races. Curve 4 indicates a reduction in the number of urosteges in *P. c. deserticola* as compared with Utah specimens and *P. c. heermanni*.

In work upon groups such as this, where individual variation is so great as almost to conceal geographic differences, I have found that the latter may be thrown into greater relief by what



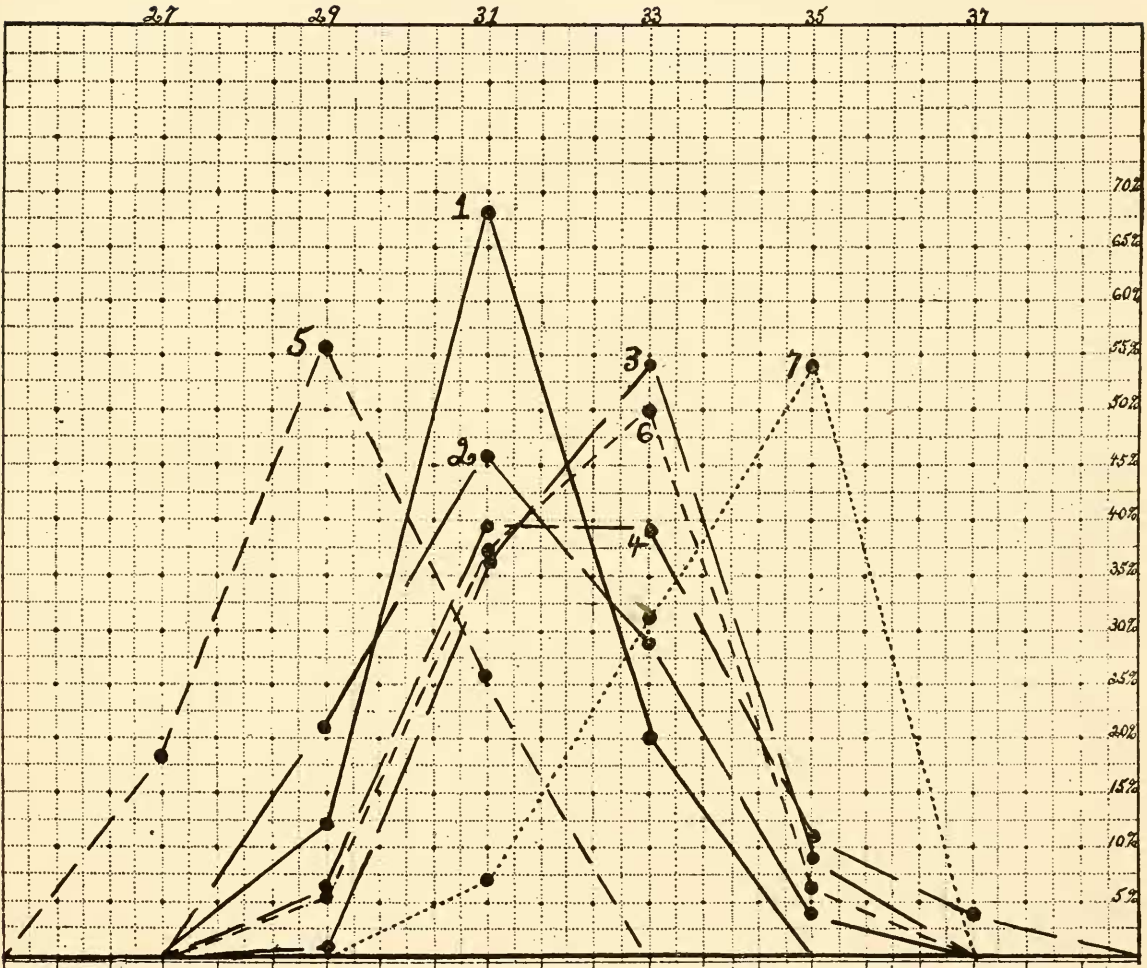


Fig. 5

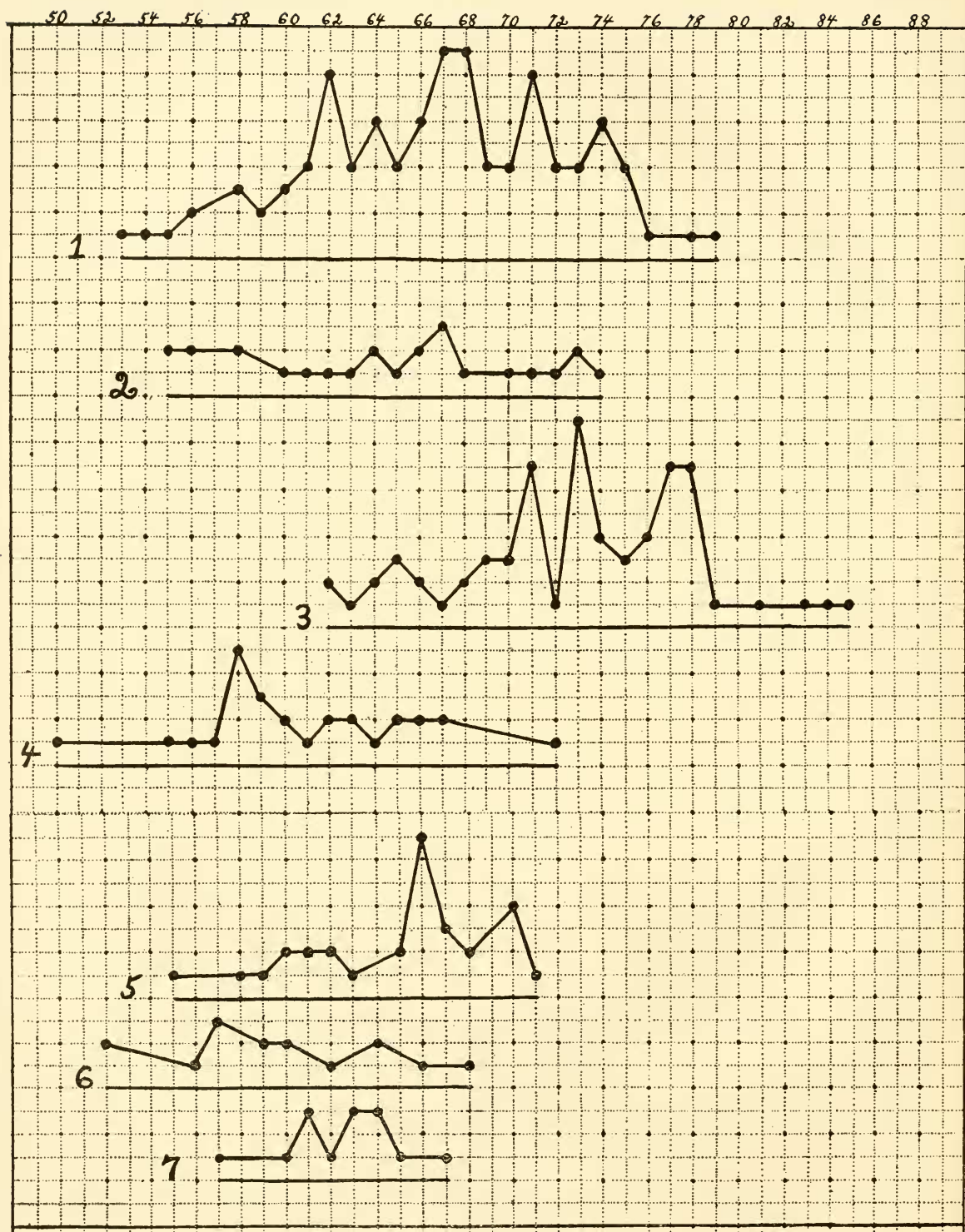


Fig. 6

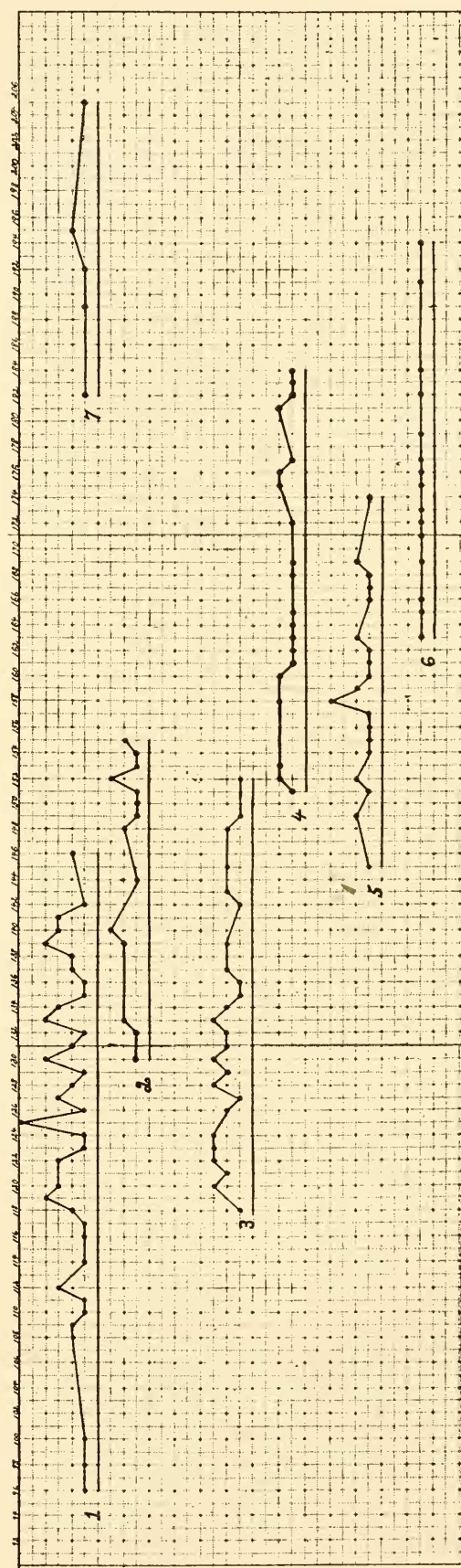


Fig. 7

I have called a summation of characters. Individual variation in any one specimen rarely affects greatly all of the characters involved in geographic variation. Therefore, by adding together, or subtracting various characters showing geographic differences, the factors of individual variation are proportionally reduced or buried, and geographical variations are less concealed.

Figure 7 represents this principle as applied to certain characters of the gopher-snakes. The number of dorsal and caudal blotches together has been subtracted from the number of gastrosteges for each specimen. Certain differences between the subspecies become at once evident. *P. c. annectens* (curve 3) stands out as very distinct from *P. c. deserticola* (4) and the snakes of Arizona and Utah (5 and 6). *P. c. heermanni* (2) is also clearly different from *P. c. deserticola* (4). The Arizona snakes (6) plainly are not like those of Utah (5), nor like the Lower Californian *P. vertebralis* (curve 7).

Still other differences between various subspecies exist but have not been charted. Thus, the snakes of Utah and Arizona most frequently have but one preocular, while the other races usually have two. In *P. vertebralis* the supralabials usually are nine, while eight is the number most frequent in the other races.

It seems, then, that instead of the three kinds of gopher-snakes which have been recognized by authors for many years, the facts will be best set forth by according recognition to seven kinds from western North America. The chief differences between these may be briefly set forth in the following table of averages. The complete scale-counts and localities are given in the earlier paper. The counts of the blotches are given here under the head of each subspecies with the numbers of the specimens and of the localities as in the former paper.

TABLE OF AVERAGE DIFFERENCES IN *PITUOPHIS*

	<i>calenifer</i>	<i>heermanni</i>	<i>annectens</i>	<i>deserticola</i>	<i>stejnegeri</i>	<i>rutilus</i>	<i>verlebralis</i>
Number of Specimens	103	28	69	28	29	16	15
Average No. of							
Gastrosteges	♂ 217 ♀ 220	♂ 219 ♀ 224	♂ 228 ♀ 231	♂ 234 ♀ 239	♂ 233 ♀ 235	♂ 227 ♀ 237	244
Urosteges	♂ 69 ♀ 64	♂ 68 ♀ 60	♂ 76 ♀ 70	♂ 64 ♀ 59	♂ 66 ♀ 60	♂ 63 ♀ 57	62
Scale-rows	31.1	31.3	32.4	32.3	29	32.1	34
Preoculars	2-2	2-2	2-2	2-2	1-1	1-1	2-2
Supralabials	8	8	8	8	8	8	9
Body blotches	70	58	74	56	58	46	44
Tail blotches	21.4	15	22.8	15.4	16.5	12.5	11

Where individual variation is so great in races which intergrade and are so closely related, it probably is impossible to make a "key" which will properly refer all specimens. However, it is believed that the following synopsis will serve this purpose for most individual specimens, and perhaps for all series of specimens from one locality.

SYNOPSIS OF SPECIES AND SUBSPECIES

- a. Coloration on anterior half of body not largely red.
 - b. The number of gastrosteges less the number of dorsal blotches on body and tail rarely exceeds 151.
 - c. Gastrosteges fewer (200 to 230), average fewer than 225; urosteges fewer (51 to 80), average in males 70, females 63; scale-rows usually (70 to 75%) not more than 31.
 - d. Dorsal blotches more numerous on body (56 to 93, average 70) and tail (14 to 30, average 21.4).
P. c. catenifer.—p. 13
 - dd. Dorsal blotches fewer on body (48 to 70, average 57.6) and tail (13 to 19, average 15).
P. c. heermanni.—p. 16
 - cc. Gastrosteges more numerous (217 to 243), average more than 225; urosteges more numerous (62 to 85), average in males 76, females 70; scale-rows usually (63%) more than 31.
 - Dorsal blotches numerous on body (54 to 89, average 74) and tail (14 to 29, average 22.8).
P. c. annectens.—p. 17
 - bb. The number of gastrosteges less the number of dorsal blotches on body and tail usually exceeds 151; gastrosteges more than 220.
 - e. The sum of the number of scale-rows and of preoculars on both sides of head rarely exceeds 33; usually one preocular.
P. c. stejnegeri.—p. 21
 - ee. The sum of the number of scale-rows and of preoculars on both sides of head usually exceeds 33.
 - f. The sum of the number of caudal blotches and preoculars of both sides of head usually exceeds 16; usually two preoculars; posterior dorsal blotches not distinctly reddish.
P. c. deserticola.—p. 19
 - ff. The sum of the number of caudal blotches and preoculars of both sides of head rarely exceeds 16; usually one preocular; posterior dorsal blotches often distinctly reddish or red-brown.
P. c. rutilus.—p. 24
 - aa. Coloration on anterior half of body largely red. Gastrosteges 233 to 257; scales usually in 35 or 33 rows; dorsal blotches few (average 44 on body, 11 on tail); supralabials usually nine or more.
P. vertebralis.—p. 27

Pituophis catenifer catenifer (Blainville)

Coast Gopher-Snake

Diagnosis.—Gastrosteges average fewer than 225; urosteges average 64 to 70; scale-rows most frequently 31; preoculars usually two; supralabials most frequently eight; dorsal blotches numerous, average on body 70, on tail 21.4; no red in coloration.

Type locality.—California.

Distribution.—The Coast Gopher-Snake occupies a rather narrow strip of territory along the Pacific Coast of the United States from Puget Sound to Santa Barbara County, California. The eastern limit of its range in the far north is not known, but does not include eastern Washington.

In southern Oregon, it occurs near Roseburg and in the Camas Mountains, in Douglas County, but not near Klamath Falls, Klamath County, where it is replaced by *P. catenifer heermanni*.

In California, it occupies the coast ranges and valleys east to the western edges of the Sacramento and San Joaquin valleys, where it intergrades with and, farther east, is replaced by, *P. catenifer heermanni* in the north and *P. catenifer deserticola* in the south. Still farther south, it probably intergrades with *P. catenifer annectens* in Santa Barbara or Ventura County. It has been taken in Siskiyou (Ft. Jones, Callahan, Mt. Shasta), Humboldt (Garberville), Trinity (Yolla Bolly Mountain), Mendocino (ten miles south from Willits), Lake (Middletown, Kelseyville, Lower Lake), Sonoma (Petaluma, Duncan Mills, Guerneville, Monte Rio), Napa (Napa), Solano (Buddha Canyon), Marin (Inverness, Point Reyes Station, Mailliard, Mt. Tamalpais, Lagunitas, Manzanita, San Anselmo), Contra Costa (Walnut Creek, Antioch, Contra Costa, San Pablo Valley, Mt. Diablo, Moraga Valley), Alameda (Berkeley, Oakland, Hayward), San Francisco, Santa Clara (Palo Alto, Stanford University, Sunnyvale, San Jose, Los Gatos, Alma, Coyote, Coyote Creek), Santa Cruz (Glenwood, Corralitos, Soquel), San Benito (San Juan), Monterey (Monterey, Carmel, Bradley, Soledad, Coburn, Welby, Metz), San Luis Obispo (San Miguel, Pismo, Edna, Indian Creek, San Juan

River, source of the Salinas River), and Santa Barbara (Santa Cruz Island) counties.

Variation.—One specimen has no loreal plates; the other one hundred and three all have the normal 1-1. The preoculars are 2-2 in seventy-nine, or 78%; 1-1 in seventeen, or 16%; and 1-2 in six, or 6%. The postoculars are 3-3 in seventy-one, or 69%; 3-4 in eighteen, or 17%; 4-4 in eleven, or 11%; 4-5 in one, or 1%; 2-3 in one, or 1%; and 2-2 in one, or 1%. The temporals are 4-4 in thirty-nine, or 38%; 3-3 in twenty-six, or 25%; 3-4 in twenty-one, or 20%; 4-5 in nine, or 9%; 2-3 in three, or 3%; 2-2 in three, or 3%; 5-5 in one, or 1%; and 2-4 in one, or 1%. The supralabials are 8-8 in fifty-six, or 54%; 8-9 in twenty-seven, or 26%; 9-9 in fourteen, or 14%; 9-10 in three, or 3%; 7-8 in two, or 2%; 10-10 in one, or 1%. The infralabials are 13-13 in thirty-two, or 31%; 12-12 in twenty-two, or 21%; 12-13 in nineteen, or 18%; 11-12 in nine, or 9%; 13-14 in seven, or 7%; 11-11 in six, or 6%; 11-13 in three, or 3%; 10-10 in three, or 3%; 14-14 in one, or 1%; and 10-11 in one, or 1%. The scale-rows are 31 in sixty-nine, or 68%; 33 in twenty, or 20%; and 29 in twelve, or 12%; the average is 31.1 rows. The gastrosteges vary in number from 200 to 230, males having from 207 to 230, females from 200 to 230; the average in fifty-four males is 217, in forty-six females is 220. The urosteges vary from 53 to 79; males having from 59 to 79, females from 53 to 78; the average in fifty-three males is 69, in forty-five females, 64.

The dark blotches between head and anus in seventy-five specimens vary from 56 to 93, the average being 70. On the tail, in eighty-three specimens, they vary from 14 to 30, and average 21.4.

The counts of blotches in the various specimens are shown below.

Number	Blotches on		Locality	Number	Blotches on		Locality
	Body	Tail			Body	Tail	
C 1589	..	..	1	43434	64	23	52
C 2314	..	..	1	S 1165	..	..	53
C 2434	..	..	1	40413	63	20	54
C 1626	66	22	1	S 4026	..	..	55
C 848	79	22	1	S 1799	71	27	55
43452	57	18	3	S 1798	69	24	55
C 849	56	17	4	S 1808	87	28	55
43519	70	21	5	S 4017	71	19	55
C 4019	67	20	6	S 1150	63	21	55
C 4018	68	21	6	41667	66	22	56
C 5614	64	18	7	S 1119	71	19	57
C 4017	59	21	8	S 1118	63	21	57
S 4220	..	..	15	S 1773	63	15	57
S 1697	66	21	16	S 1168	67	20	57
S 1741	70	18	16	S 1117	71	21	57
30888		23	17	S 5806	73	17	57
C 5285	74	23	19	S 1749	59	18	57
27326	77	24	20	S 1748	64	23	57
C 975	74	22	21	S 1752	67	24	57
C 4845	68	20	22	S 7195	..	..	57
C 5283	77	28	23	S 1167	..	..	57
C 5282	93	28	23	S 4042	..	..	57
43377	67	19	33	S 4047	..	..	57
13766	80	23	34	S 4044	..	..	57
13767	85	25	34	S 4045	..	..	57
13768	78	20	34	S 4043	..	..	57
13769	75	22	34	S 1747	..	..	57
13770	84	22	34	S 1171	..	..	57
17858	68	27	34	S 1169	57	22	57
43375	76	22	35	S 1751	58	14	57
43376	66	19	35	41671	61	21	57
43321	72	18	36	43440	69	21	58
43322	69	20	36	S 4092	73	25	59
43379	69	20	37	S 1681	82	27	60
43373	67	19	38	S 1772	84	26	60
43374	70	24	38	36061	66	21	61
C 4312	..	..	39	S 1740	62	20	62
43412	71	23	41	43523	71	23	63
39261	62	20	42	27942	74	27	64
43274	78	25	44	C 4911	84	30	65
43418	62	22	45	C 4131	74	23	66
43419	72	20	45	C 5284	75	23	68
43364	85	22	46	29492	71	21	70
43365	66	22	46	S 4062	..	..	71
43413	49	16	47	44194	69	20	73
43414	74	19	48	44943	77	23	76
43382	73	22	49	45119	63		41
36120	66	18	50	45120	88	24	77
36121	56	17	50	45121	72	19	77
45131	70	23	50	45127	71	24	78
C 6166	..	..	51				

Pituophis catenifer heermanni (Hallowell)

Valley Gopher-Snake

(Plate 1, fig. 1)

Diagnosis.—Gastrosteges average fewer than 225; urosteges average 60 to 68; scale-rows most frequently 31; preoculars usually two; supralabials most frequently eight; dorsal blotches fewer, average on body 58, on tail 15; no red in coloration.

Type locality.—Cosumnes River, California.

Distribution.—The Klamath region, Oregon, and in California, Modoc County, the Sacramento Valley, the northern part of the San Joaquin Valley, and the western slope of the Sierra Nevada. In Oregon it has been taken near Klamath Falls, Klamath County. Californian specimens have been collected in Modoc (Canby, Goose Lake Meadows, Sugar Hill, between Alturas and Davis Creek, Dry Creek in the Warner Mts.), probably Shasta (McCloud River), Tehama (Tehama), Glenn (Fruto, Winslow), Butte (between Live Oak and Gridley), Yolo (Grand Island Landing), Placer (Lander near Colfax), El Dorado (Fyffe, Riverton), San Joaquin (Tracy), Merced (Los Baños, Snelling), Mariposa (between Kinsley and Maculey's Stage Station, Coulterville, Pleasant Valley), Madera (vic. Madera), and Fresno (King's River, Dunlaps, Clovis) counties.

Variation.—The loreal is 1-1 in all of the twenty-eight specimens. The preoculars are 2-2 in twenty-six, or 93%; and 1-1 in two, or 7%. The postoculars are 3-3 in twenty-three, or 85%; 4-4 in three, or 11%; and 4-5 in one, or 4%. The temporals are 4-4 in eleven, or 45%; 3-4 in five, or 21%; 5-5 in three, or 13%; 3-3 in three, or 13%; 4-6 in one, or 4%; and 2-3 in one, or 4%. The supralabials are 8-8 in twelve, or 48%; 8-9 in eight, or 32%; and 7-7, 7-8, 9-9, 9-10, and 10-10, each in one, or 4%. The infralabials are 13-13 in twelve, or 50%; 12-12 in six, or 25%; 14-14 in two, or 8%; 12-13 in two, or 8%; and 12-14 and 11-14 each in one, or 4%. The scale rows are 31 in thirteen, or 46%; 33 in eight, or 29%; 29 in six, or 21%; and 35 in one, or 4%; the average is 31.3 rows. The gastrosteges vary in number from 209 to 231, males having from 209 to 231, females from 218 to 231; the average in six-

teen males is 219, in twelve females, 224. The urosteges vary from 55 to 74, males having from 61 to 74, females from 55 to 66; the average in fifteen males is 68, in eleven females is 60.

The dark blotches between head and anus in twenty-eight specimens vary from 48 to 70, the average being 57.6. On the tail, in thirty-two specimens, they vary from 13 to 19, and average 15. The counts of the blotches are shown below.

Number	Blotches on		Locality	Number	Blotches on		Locality
	Body	Tail			Body	Tail	
C 4012	70	23	2	C 3608	54	14	27
S 5631	61	19	9	C 5595	59	15	28
S 5633	59	23	9	C 2080	63	24	29
39637	62	19	10	C 2081	60	17	30
27333	63	19	11	C 2082	56	19	31
C 6264	..	..	12	C 2083	56	20	32
C 4016	55	16	13	S 6500	..	..	40
C 4015	57	14	14	43521	48	15	43
C 4014	63	21	14	43522	56	15	43
41670	50	16	18	C 2759	57		43
C 5883	54		24	C 4013	63	20	67
C 5884	55	17	24	C 4011	58	19	69
C 5885	53	14	25	20413	65	16	72
C 5886	51	17	26	44161	58	18	74
41699	50	15	27	44241	57	18	75

Pituophis catenifer annectens (Baird & Girard)

San Diegan Gopher-Snake

(Plate 1, fig. 2)

Diagnosis.—Gastrosteges average more than 225; urosteges numerous, average 70 to 76; scale-rows most frequently 33; preoculars usually two; supralabials most frequently eight; dorsal blotches many, average on body 74, on tail 22.8; no red in coloration.

Type locality.—San Diego, California.

Distribution.—This subspecies occupies the coast region of southern California and northern Lower California, and has been found on some of the islands off the coast. We have examined specimens from Santa Barbara (Santa Barbara), Ventura (Pine Creek), Los Angeles (Charter Oak, Cold Water Canyon, La Crescenta, Pasadena, Mt. Wilson, Sierra Madre),

San Bernardino (Ontario), Riverside (Colton, San Bernardino Mts., Riverside, San Jacinto, San Jacinto Mts.), and San Diego (Warner Pass, Agua Caliente, Cahuilla Valley, Julian, Cuyamaca Mts., Campo), counties, California, and from Ensenada, San Martin Island, and South Coronado Island, Lower California.

It is probably this subspecies of gopher-snake which has been observed, but not captured, on Santa Catalina Island. Those of Santa Cruz Island, however, are *Pituophis catenifer catenifer*.

Variation.—Sixty-nine specimens all have loreals 1-1. The preoculars are 2-2 in forty-four, or 64%; 1-1 in twenty, or 29%; and 1-2 in five, or 7%. The postoculars are 3-3 in forty, or 59%; 4-4 in thirteen, or 19%; 3-4 in eleven, or 16%; and 2-3, 2-4, 4-5, and 5-5, each in one. The temporals are 4-4 in twenty-three, or 34%; 3-3 in fifteen, or 22%; 3-4 in twelve, or 18%; 4-5 in five, or 7%; 5-5 in five, or 7%; 3-5 in two, or 3%; and 2-2, 2-3, 2-4, 4-6, and 5-6, each in one. The supralabials are 8-8 in thirty-three, or 48%; 9-9 in nineteen, or 27%; and 8-9 in seventeen, or 25%. The infralabials are 13-13 in thirty-four, or 49%; 13-14 in ten, or 14%; 12-12 in eight, or 12%; 12-13 in seven, or 10%; 14-14 in three, or 4%; 11-13 in two, or 3%; and 10-11, 11-11, 11-12, 12-14, and 14-15, each in one. The scale-rows are 33 in thirty-seven, or 54%; 31 in twenty-five, or 36%; 35 in six, or 9%; and 29 in one, or 1%; the average is 32.4 rows. The gastrosteges vary in number from 217 to 243, males having from 217 to 243, females from 218 to 240; the average in forty-three males is 228, in twenty-five females, 231. The urosteges vary from 62 to 85, males having from 62 to 85, females from 62 to 83; the average in thirty-nine males is 76, in twenty-four females, 70.

The dark blotches between head and anus in seventy-one specimens vary from 54 to 89, the average being 74. On the tail in sixty-five specimens they vary from 14 to 29, and average 22.8. The counts of the blotches are shown in full below.

Number	Blotches on		Locality	Number	Blotches on		Locality
	Body	Tail			Body	Tail	
8575	85	23	1	S 1163	..	..	37
8678	69	19	2	S 1162	79	27	37
13588	63	19	3	S 4050	71	21	38
13589	63	21	3	40060	69	25	39
S 5163	65	20	17	40061	82	24	39
38918	73	22	18	40062	75	22	39
40003	83	22	19	40063	84	27	39
C 4311	73	21	20	40064	82	24	39
C 749	74	23	21	40065	79	25	39
C 750	67	20	21	40066	75	19	39
C 4313	78	21	22	40067	77	20	39
C 4310	69	21	22	40068	81	28	39
27534	65	20	22	40069	73	23	39
27774	71	18	22	40070	77	24	39
27806	76	25	22	40071	73	19	39
C 75	73	20	24	40072	69	21	39
S 1197	81	24	25	40073	69	22	39
S 1164	71	26	25	40074	79	25	39
S 1784	61	18	25	40075	71	21	39
S 1166	72	22	25	40076	80	26	39
S 1122	65	24	25	40077	78	26	39
S 4008	74	26	25	40078	72	20	39
S 1146	75	26	25	40079	81		39
S 1135	78	29	25	40080	76	24	39
S 1750	68	22	25	40081	79	24	39
C 104	89	29	26	40082	76	19	39
C 553	75	20	26	C 623	75	24	40
C 343	72	24	26	C 622	72	19	41
C 551	87	26	26	S 1160	79	26	42
C 552	78	23	26	S 1149	77	26	42
S 5240			28	S 1155	73	21	42
S 6464	78	20	29	C 1040	79	28	43
S 4291	81	21	31	C 3819	71		44
S 4268	80	24	31	43520	80	24	45

Pituophis catenifer deserticola Stejneger

Desert Gopher-Snake

Diagnosis.—Gastrosteges average more than 230; urosteges average 59 to 64; scale-rows usually 31 or 33; preoculars usually two; supralabials most frequently eight; dorsal blotches fewer, average on body 56, on tail 15.4; sometimes some orange, but not distinct red, in coloration.

Type locality.—The Great Basin and the southwestern deserts.

Distribution.—The Colorado and Mohave deserts, the southern part of the San Joaquin Valley, eastern San Luis Obispo

County, the valleys east of the Sierra Nevada in California, and probably nearly all of Nevada; possibly Idaho and eastern Washington.

From Nevada, I have examined specimens of this subspecies from Humboldt (Thousand Creek Flat, Virgin Valley, Big Creek Pine Forest Mountains), Washoe (Pyramid Lake, Nixon), Ormsby (Carson), Lander (Austin), Elko (Carlin) and Esmeralda (Palmetto Mountains), counties.

Californian specimens examined have been collected in Imperial (Silsbee), Riverside (Mecca), San Bernardino (Victorville, Hesperia), Mono (Benton), Kern (Walker Pass, Tehachapi Mountains, Isabella, Delano, Bakersfield, Buttonwillow), and San Luis Obispo (Simmler, Pozo, Palo Prieto, Shandon) counties.

Variation.—Twenty-eight specimens from California and western Nevada show the following variations: The loreals are 1-1 in all. The preoculars are 2-2 in twenty-four, or 86%; 1-2 in two, or 7%; and 1-1 in two, or 7%. The postoculars are 3-3 in twenty-two, or 79%; 4-4 in five, or 18%; and 3-4 in one, or 3%. The temporals are 3-4 in eleven, or 39%; 4-4 in five, or 18%; 4-5 in four, or 14%; 5-5 in three, or 11%; and 2-3, 3-3, 3-5, 5-6, and 6-6, each in one, or 3%. The supralabials are 8-8 in seventeen, or 61%; 8-9 in six, or 21%; 9-9 in four, or 14%; and 8-10 in one, or 4%. The infralabials are 13-13 in thirteen, or 46%; 12-12 in six, or 21%; 12-13 in four, or 14%; 12-14 in two, or 7%; 13-14 in two, or 7%; and 14-14 in one, or 4%. The scale-rows are 33 in eleven, or 39%; 31 in eleven, or 39%; 35 in three, or 11%; 29 in two, or 7%; and 37 in one, or 4%; the average is 32.3 rows. The gastrosteges vary in number from 223 to 263, males having from 224 to 252, females from 223 to 263; the average in twelve males is 234, in sixteen females, 239. The urosteges vary from 50 to 72, males having from 58 to 72, females from 50 to 67; the average in twelve males is 64, in fifteen females, 59.

The dark blotches between head and anus in twenty-eight specimens vary from 46 to 66, the average being 55. On the tail they vary from 12 to 21, and average 15.4. The counts of these blotches are shown in full below.

Number	Blotches on		Locality	Number	Blotches on		Locality
	Body	Tail			Body	Tail	
C 1003	52	12	10	43383	66	18	33
C 2761	54	15	11	43347	60	18	34
C 2760	52	16	11	43429	50	15	35
39553	55	17	12	C 2763	53	17	36
43381	56	16	13	C 2764	56	17	36
39595	62	21	14	S 5649	50	14	48
38958	56	19	15	C 1529	53	13	49
38959	55	16	15	C 1528	51	14	49
C 2798	47	13	16	C 1274	51	15	50
C 3716	46	12	23	C 1275	52	14	51
C 3715	63	15	23	C 1276	54	16	51
C 469	62	16	27	S	53	14	53
C 470	56	15	27	S	54	14	54
C 471	54	12	27	S 6406	61	15	55
36285	64		30	40504	58	17	55
C 5365	52	14	32				

***Pituophis catenifer stejnegeri*, new subspecies**

Utah Gopher-Snake

(Plate 2, fig. 1)

Diagnosis.—Gastrosteges average more than 230; urosteges average 60 to 66; scale-rows most frequently 29; preocular most often single; supralabials usually eight; dorsal blotches fewer, average on body 58, on tail 16.5; no distinct red in coloration.

Type.—Cal. Acad. Sci. No. 14203, adult male, collected by Joseph C. Clemens, at Fort Douglas, Salt Lake County, Utah, June to July 4, 1908.

Description.—Head somewhat flat-topped, with snout projecting and rather narrow. Temporal regions not swollen. Rostral plate very large, prominent, not very narrow, often recurved between internasals on top of snout; bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head are a pair of internasals, a variable number of prefrontals (normally four), a frontal, supraocular of each side, and a pair of parietals. Anterior and posterior nasals usually distinct. Loreal usually elongate. Preoculars usually one, occasionally two. Postoculars usually three, often two. Supra-

labials usually eight, often nine. Infralabials usually 13, often 12, sometimes 11 or 14. Temporals of first row varying from two to five, usually four. Genials in two pairs, anterior larger. Scales on body in 27 to 33 rows, usually 29, keeled except in a varying number of rows on each side. Anal plate not divided. Gastrosteges varying in number from 223 to 241, males having from 227 to 241, females from 223 to 240. Urosteges in two series of from 55 to 71, males having from 58 to 71, females from 55 to 62.

The ground color is pale brownish or grayish-yellow, sometimes more or less obscured by the spreading of the blotches or the presence of black or dark brown marks along the keels of its scales. Along the middle of the back, from the head to a point over the anus, is a series of from 50 to 68 (average 58) dark blotches. These blotches are brown on the central part of the body but are black anteriorly and posteriorly. On the upper surface of the tail are from fourteen to twenty (average 16.5) blackish blotches. On the anterior portion of the body the blotches are more or less rounded, but posteriorly they tend to become quadrate. There are several series of alternating, often more or less confluent, dark blotches or spots on the sides. Across the top of the head, between the preocular plates, is a moderately narrow brown band, very definite and well-defined. There are similar bands or spots below the center of the eye and running back and down from the upper postocular plate. The top of the head posteriorly has a few, small, scattered, dark spots. The spaces between the dark dorsal blotches on the posterior portion of the body are yellow or orange-yellow, usually somewhat obscured by dark brown streaks along the keels of the scales. The lower surfaces are yellow or yellowish-white with irregular spots or blotches of dark brown or black on the gastrosteges and urosteges. There is no definite median subcaudal black band.

Length to anus...	758	800	863	1028	1125	1125
Length of tail...	126	148	168	179	190	207

Variation.—Twenty-nine specimens from Utah show the following variations: The loreals are 1-1 in all. The preoculars are 1-1 in twenty-one, or 87%; and 2-2 in three, or 13%

of those undamaged. The postoculars are 3-3 in twelve, or 52%; 2-2 in ten, or 43%; and 2-3 in one, or 4%. The temporals are 3-4 in ten, or 43%; 4-4 in seven, or 31%; 4-5 in three, or 13%; 3-3 in one, or 4%; 2-3 in one, or 4%; and 3-5 in one, or 4%. The supralabials are 8-8 in thirteen, or 56%; 8-9 in five, or 22%; and 9-9 in five, or 22%. The infralabials are 13-13 in eight, or 38%; 12-13 in five, or 24%; 12-12 in four, or 18%; 11-11 in two, or 9%; 11-12 in one, or 5%; and 13-14 in one, or 5%. The scale-rows are 29 in fifteen, or 56%; 31 in seven, or 26%; and 27 in five, or 18%; the average is 29 rows. The gastrosteges vary in number from 223 to 241, males having from 227 to 241, females from 223 to 240; the average in twenty-two males is 233, in five females, 235. The urosteges vary from 55 to 71, males having from 58 to 71, females from 55 to 62; the average in twenty-three males is 66, in five females, 60.

The dark blotches between head and anus in twenty-nine specimens vary from 50 to 68, the average being 58. On the tail they vary from 14 to 20, and average 16.5. The counts of the blotches are given in full below.

Number	Blotches on		Locality	Number	Blotches on		Locality
	Body	Tail			Body	Tail	
40961	66	16	56	14194	56	14	57
14207	54	14	57	14195	50	14	57
27198	64	17	57	14196	58	15	57
27199	52	15	57	14197	63	19	57
30913	51	16	57	14198	59	16	57
30914	60	18	57	14199	50	16	57
30915	61	20	57	14200	54	19	57
30916	61	17	57	14201	57	19	57
30917	54	16	57	14202	56	18	57
30918	61	16	57	14203	61	16	57
30919	63	16	57	14204	54	14	57
30920	53	18	57	14205	58	16	57
38756	63	18	57	14206	54	16	57
38757	60	14	57	38755	68	17	58
14193	66	18	57				

Distribution.—Specimens of this subspecies are at hand from Thompson, Grand County, Wasatch Mountains, Wasatch County, and Fort Douglas, Salt Lake County, Utah.

Remarks.—Three snakes from Boise, Ada County, and Blue Lakes, Twin Falls County, Idaho, and one from Wallula,

Walla Walla County, Washington, may belong here rather than with *P. catenifer deserticola*, but their final disposition must await additional material. They have twenty-nine and thirty-one scale-rows and one or two preoculars (50% each), and gastrosteges from 231 to 244.

***Pituophis catenifer rutilus*, new subspecies**

Arizona Gopher-Snake

(Plate 2, fig. 2)

Diagnosis.—Gastrosteges numerous, average more than 225; urosteges average 57 to 63; scale-rows most frequently 33; preocular normally single; supralabials usually eight; dorsal blotches very few, average on body 46, on tail 12.5; coloration often somewhat reddish posteriorly.

Type.—Cal. Acad. Sci. No. 33869, adult female, collected by J. R. Slevin at Tucson, Pima Co., Arizona, April 11, 1912.

Description.—Head somewhat flat-topped, with snout projecting and rather narrow. Temporal regions not swollen. Rostral plate very large, prominent, not very narrow, often recurved between internasals on top of snout; bounded behind by internasal, anterior nasal, and first labial plates. Plates on top of head are a pair of internasals, a variable number of prefrontals (normally four), a frontal, supraocular of each side, and a pair of parietals. Anterior and posterior nasals usually distinct. Loreal usually elongate. Preocular usually one, occasionally two. Postoculars usually three, often four, sometimes five. Supralabials usually eight, often nine, rarely 10. Infralabials usually 12, often 13, sometimes 11 or 14. Temporals of first row varying from two to five, usually four. Genials in two pairs, anterior larger. Scales on body in 29 to 35 rows, usually 33, keeled except in a varying number of rows on each side. Anal plate not divided. Gastrosteges varying in number from 222 to 258, males having from 222 to 237, females from 227 to 258. Urosteges in two series of from 52 to 68, males having from 57 to 68, females from 52 to 60.

The ground color is pale yellow or grayish-yellow, sometimes more or less obscured by the spreading of the blotches

or the presence of dark keels on the scales, especially laterally and anteriorly. Along the middle of the back, from the head to a point over the anus, is a series of from 37 to 55 (average 46) reddish-brown blotches. The brown of these blotches becomes darker and redder posteriorly. These blotches often are margined with black. On the upper surface of the tail are from ten to fourteen (average 12.5) dark reddish-brown blotches or cross bands. On the anterior part of the body the blotches tend to be more or less rounded, posteriorly they are more quadrate, or are wider with concave anterior and posterior borders. There are two or three series of alternating, often more or less confluent, dark blotches or spots on the sides. Across the top of the head between the preocular plates is a narrow brown band, more or less obsolete in adults. There are similar bands or spots below the center of the eye and running back and down from the upper postocular plate. The top of the head is light brownish-yellow, speckled with black. The spaces between the dark dorsal blotches on the posterior part of the body are light yellowish or grayish-orange, usually without dark marks on the keels of the scales. The lower surfaces are yellow or yellowish-white, with irregular spots or blotches of light or dark brown on the gastrosteges and urosteges. There is no definite median subcaudal dark band.

Length to anus.....	456	1050	1115	1130	1140
Length of tail.....	68	154	153	183	165

Variation.—Sixteen specimens from Arizona show the following variations: The loreals are 1-1 in all. The preoculars are 1-1 in ten, or 62%; 2-2 in five, or 31%; and 1-2 in one, or 6%. The postoculars are 3-3 in six, or 37%; 3-4 in five, or 31%; 4-4 in four, or 25%; and 4-5 in one, or 6%. The temporals are 4-4 in seven, or 47%; 3-3 in three, or 20%; 3-4 in two, or 13%; 4-5 in two, or 13%; and 2-3 in one, or 7%. The supralabials are 8-8 in eight, or 50%; 8-9 in three, or 19%; 9-9 in three, or 19%; 9-10 in one, or 6%; and 8-10 in one, or 6%. The infralabials are 12-12 in nine, or 60%; 13-13 in three, or 20%; 13-14 in one, or 6%; 14-14 in one, or 6%; and 11-11 in one, or 6%. The scale rows are 33 in eight, or 50%; 31 in six, or 37%; 29 in one, or 6%; and 35 in one, or 6%; the average is 32.1 rows. The gastrosteges vary in number from

222 to 258, males having from 222 to 237, females from 227 to 258; the average in six males is 227, in nine females, 237. The urosteges vary from 52 to 68, males having from 57 to 68, females from 52 to 60; the average in six males is 63.5, in nine females, 57.

The dark blotches between head and anus in 16 specimens vary from 37 to 55, the average being 46. On the tail they vary from 10 to 14, and average 12.5. The counts of these blotches are given in full below.

Number	Blotches on		Locality	Number	Blotches on		Locality
	Body	Tail			Body	Tail	
34755	39	10	4	33869	48	13	8
17541	50	12	5	33870	44	13	8
17546	40	11	5	33447	54	13	9
17547	45	13	5	C	43	12	..
C 1824	54	14	6	C	50	14	..
S 1131	55	13	7	C	37		..
S 1705	42	13	7	C	51	13	..
S 1714	42	11	7	C	46	14	..

Distribution.—I have examined specimens of the Arizona Gopher-Snake taken at Yuma, Yuma County, the Colorado River above Bill Williams River, Mohave County, Cave Creek, Maricopa County, Fort Lowell and the Santa Cruz River near Tucson, Pima County, and the Huachuca Mountains, Cochise County, Arizona. Specimens of *Pituophis* from Arizona have been recorded as collected at Oak Orchard, Camp Grant, Wilton Springs, Tucson, Gila River, White River Canyon, Fort Whipple, Grand Canyon, and at Las Gijas in Pima County.

Remarks.—The specimens from Mohave and Yuma counties, and a specimen from Silsbee, Imperial County, California (referred to *P. c. deserticola*) show more or less intergradation between the Arizona and the Desert Gopher-Snakes. These specimens have very many gastrosteges, while those from extreme southeastern Arizona have fewer. Indeed, some of the latter have so few as to indicate intergradation with the gopher-snakes of New Mexico which Ruthven has referred to *P. c. sayi*, but which may possibly require recognition as a distinct subspecies, *P. sayi affinis* (Hallowell).

Habits.—Ruthven states that a large specimen, secured near Tucson about sun-down on August 22, had recently swallowed an adult ground squirrel. These snakes live both on the desert plains near sea level and in mountain cañons to an altitude of at least 5,300 feet.

***Pituophis vertebralis* (Blainville)**

San Lucan Gopher-Snake

Diagnosis.—Gastrosteges average more than 240; urosteges average 62; scale rows most frequently 35; preoculars usually two; supralabials usually nine or 10; dorsal blotches very few, average on body 44, on tail 11; much red in coloration.

Type locality.—"California."

Distribution.—The southern half of the peninsula of Lower California, Mexico.

Variation.—Fourteen specimens show the following variations: The loreal is 1-1 in all counted (six). The preoculars are 2-2 in thirteen, or 93%; 1-1 in one, or 7%. The postoculars are 3-3 in fourteen, or 100%. The temporals in five specimens are 4-4 in three, or 60%; 3-4 in one, or 20%, and 4-5 in one, or 20%. The supralabials are 9-9 in seven, or 50%; 9-10 in five, or 36%; 8-9 in one, or 7%; and 8-10 in one, or 7%. The infralabials are 12-12 in seven, or 50%; 13-13 in three, or 22%; 13-14 in two, or 14%; 12-13 in one, or 7%; and 14-16 in one, or 7%. The scale-rows are 35 in seven, or 54%; 33 in four, or 31%; 34 in one, or 7%; and 31 in one, or 7%; the average is 34 rows. The gastrosteges in fifteen specimens vary from 233 to 257, the average being 244; two males average 242, four females average 250. The urosteges in fourteen specimens vary from 57 to 67; the average being 62; two males average 63, and three females, 60.

The dark blotches between head and anus in six specimens vary from 39 to 48, the average being 44. On the tail in six specimens they vary from 10 to 12, and average 11.

Counts of the dorsal blotches on the body and tail in six specimens are 45, 10; 39, 11; 48, 11; 43, 10; 44, 11; and 45, 12.